Description

The present invention relates to a radar camouflaged device for deploying ammunition in mobile objects, in particular vehicles, in accordance with the preamble of claim 1, wherein an opening provided in the body shell of the object for deploying the ammunition may again reversibly be closed following deployment of the ammunition, to thereby reduce a heightening of the radar signature of the object caused by this opening and having a negative effect.

The invention moreover relates to a method for enhancing the radar camouflage of a mobile object in accordance with the preamble of claim 31 through reversible, radar camouflaged covering of any ammunition deployment openings in the body shell of the object.

Mobile objects, in particular weapons carriers such as water, air and land vehicles as a general rule have a metallic body shell. Moreover they are frequently provided with structures having a prominent position and a particular shape. The result of this is a large, characteristic radar reflecting surface. This is referred to as the radar signature of an object.

This radar signature is typical for a target, is measurable, and therefore is decisive for reconnaissance and for anti-reconnaissance action. For example, autonomously operating modern missiles utilize the radar signature of a mobile object in the acquisition and destruction of a target. This threat is strongly increasing owing to the collapse of the former superpower

Soviet Union as well as liberal export regulations of Asian states in particular.

At present, four different groups of electronic countermeasures are taken in order to meet this danger. Among them are the use of jamming and deceptive response transmitters, destruction of the threat by anti-radar missiles (ARM), the use of artificial reflectors (corner, chaff, etc.), and the use of radar-absorbing material (RAM).

The two groups named last shall presently be dealt with in particular.

Whereas radar chaff was already used in World War II against radar apparatus having reconnaissance and fire direction tasks, containing mainly aluminum strips as radar-scattering elements, technology has meanwhile progressed far in this field.

Chaff is nowadays used both for masking intruding units and for self-protection. In the former case, a large chaff volume is deployed at one time, while in the latter case individual clouds of chaff are deployed so as to render hostile reconnaissance difficult, thus from the outset preventing the radar sensor from locking on in the search phase by timely placement of phantom targets, or in order to effect a transfer of an already successful radar lock-on from the target deploying the chaff to a phantom target. These phantom targets are comprised of a multiplicity of lightweight active bodies.

As modern missiles do, however, nowadays frequently have a target-seeking head that determines the position of a target object in the infrared (IR) or radar (RF) range, or simultaneously or sequentially in both

wavelength ranges, the active bodies deployed for deflecting the missiles equally have to simulate both IR and RF targets.

Such IR active bodies are disclosed in German patent specification DE 34 21 692 C2. The IR phantom target is in this case represented by a cloud of burning strips of material, which are successively ignited in a chain of ignitions.

Seeking heads operating both in the IR and RF ranges are so-called dual-mode target-seeking heads that are met with combined IR and RF phantom targets. Such combined IR/RF decoys are disclosed in DE 199 51 767 A1, for example.

In addition to enticing the missile that was evaluated as a potential threat away from the actual target to a spurious target, it is one more promising strategy to prevent the missile from accurately homing in on its target and thus generally render target acquisition by the missile difficult. This is achieved by diminishing the radar signature of the target object.

This may be achieved by coating the body shell of the target object with a radar-absorbing or radar-scattering coating.

Patent No. CN 1135439 discloses an airplane, the body shell of which is coated with a semiconductor layer that absorbs electromagnetic waves to thereby diminish its radar signature.

Further radar camouflage coatings of flexible silicone or urethane rubber are available, e.g., from "Millimeter Wave Technology, Georgia, USA", who equip

more than 90% of U.S. Navy military vessels with radar-absorptive materials.

A particularly effective defense against modern missiles may thus be achieved by equipping a mobile object to be protected both with a RAM coating and with a launcher for deploying ammunition, in particular RF/IR active bodies. In this way it is made more difficult for the approaching missile to acquire the radar signature of the actual target object, and at the same time it is enticed away from the actual target object by a deployed spurious target.

This combination of radar camouflage coating of the object to be protected and equipping it with a launcher for deploying ammunition does, however, harbor decisive drawbacks.

Weapons systems for installation on low-radar signature mobile objects currently have their radar signature reduced by suitable shapes and choice of materials. Despite all the measures on these weapons systems, however, the overall signature of the object is worsened by the structure inasmuch as the total reflective surface of the vehicle is increased.

In addition undesirable multiple reflections may occur between the body shell of the object and the outer shell of the weapons system, which may generate a backscattering signal in the order of a multiple of the direct reflection.

In order to circumvent this problem, it is possible to position the required launcher on the inside of the body shell of the object.

When the launcher for deploying ammunition is located on the inside of the radar camouflaged body shell of the object to be protected, however, it is necessary for the body shell to be partly disrupted in order to permit passage of the ammunition through it. This disruption does, however, in turn bring about an increase of the radar signature of the object to be protected, with the result of the latter more easily being detected by approaching missiles.

Moreover by the required disruption of the body shell an opening is caused through which substances and materials may penetrate from outside into the object to be protected. In the case of ships this may be saltwater, for instance, which might attack the launcher located behind, to shorten its lifetime. Gases or noxious fluids are also conceivable as an example, and also materials introduced by the opponent, such as explosives or other warfare agents.

Based on the prior art it would thus be desirable to have a device for deploying ammunition at one's disposal on the inside of the body shell of the object to be protected, which avoids the above mentioned drawbacks.

Accordingly it is an object of the present invention to provide a device for deploying ammunition on the inside of the body shell of the object to be protected, which avoids the necessity of a permanent opening in the body shell, so that hereby a significant heightening of the radar signature of the object and the occurrence of a continuous possibility of substances and materials of any kind entering from the outside to the inside through the opening for deploying ammunition in the body shell are avoided.

In terms of device technology, the object is attained by a device having the characterizing features of claim 1.

In terms of method technology, the object of the invention is attained by a method having the characterizing features of claim 31.

One embodiment of the invention relates to a device for deploying ammunition, wherein a recess provided for this purpose in the body shell of a mobile object is covered by cover means, so that a heightening of the radar signature caused by this recess and having a negative effect is diminished.

In another embodiment of the invention, the ammunition is deployed with the aid of a launcher located on the inside of the body shell of the object.

The launcher may have at least one discharge tube.

In a preferred embodiment of the invention, the launcher terminates so as to be flush with the body shell of the object.

Advantageously the launcher is arranged at a distance of 0-20 cm, preferably 0.5-15 cm, more preferably 1-5 cm, from the body shell of the object.

The launcher tubes may be arranged on the inside of the body shell so that loading the launcher tube(s) from the inside is possible.

The launcher tubes are as a rule accommodated in a launcher housing, however may also be designed as independent tubes.

Another embodiment of the invention may provide for the launcher housing to be fixedly connected to the inside of the body shell.

It is preferred in accordance with the present invention if the launcher housing has at least one closable hatch in the interior range of the object, through which loading the discharge tubes takes place.

In another embodiment of the invention the hatch may be a squeeze lock. Hereby rapid opening and closing of the loading hatch is achieved.

Between launcher housing opening and body shell and/or between loading hatch and loading opening of the launcher housing a gas-tight seal may be provided. Hereby it is ensured that contamination of the inner space cannot occur.

In another preferred embodiment of the invention, the launcher housing is provided with a blow-off valve.

This is advantageous for occasionally cleaning the launcher tubes through pressurized air pulses.

In another embodiment of the invention, the launcher housing is provided with outlet means, e.g. to again remove water penetrated to the inside.

Moreover the launcher housing is provided with a connection facility for control through the intermediary of ignition means, wherein it is preferred to use electrical ignition means.

It is moreover preferred if the launcher housing has grounding means to establish the necessary protective ground.

In another embodiment of the invention, the angle of deployment of the discharge means is adjustable in lateral pointing and elevation with the aid of adapters. Thus advantageously a large area of covered space is ensured, so that decoys may be deployed effectively.

With the present invention it is possible to protect land vehicles, aircraft and/or water craft more effectively than in the prior art. In this context, the present invention is of great importance for the optimum protection of ships.

In another embodiment of the invention, the cover means has a radar camouflage coating, where it is advantageous that the cover means covers the recess to such an extent that a radar camouflaged structure of the body shell is preserved virtually in its entirety.

In another embodiment of the invention, the cover means is briefly opened by the penetrating body, such as decoy ammunition, to then close again.

The cover means has at least one camouflage hatch.

It is, however, also conceivable to provide a plurality of camouflage hatches; thus the camouflage hatch may, for instance, have the form of a single hatch, wing hatches, or annular or polygonal, e.g. triangular hatch segments. Such polygonal embodiment of the camouflage hatch has the advantage that the load on the hatch articulations is distributed to several hatches, whereby wear is minimized.

In another embodiment of the invention, the cover means comprises at least one elastic, in particular rubber-type, material.

Preferably the rubber-type material is morevoer provided with a radar-scattering coating so as to ensure homogeneity of the vehicle silhouette.

In another embodiment of the invention, the radar-scattering coating consists of metal foil.

Moreover it is preferred particularly in the case of ships to additionally provide the device with a splash-proof protective cover which is removed by a first discharge of ammunition.

In another embodiment of the invention, the protective cover is also of a radar-reflecting type.

Sensibly the protective cover terminates flush with the body shell, so that no additional radar edges are crerated which might indicate a target to a guided missile.

In another embodiment of the invention, the protective cover is retained by a snap-in means.

The present invention moreover encompasses a method for enhancing the radar camouflage of a mobile object, wherein all of the recesses in the body shell of a mobile object for the deployment of ammunition are covered by a reversible cover means, whereby a heightening of the radar signature caused by these recesses and having a negative effect is prevented.

Further advantages and features of the present invention result from the description of embodiments and by reference to the drawings, wherein:

Fig. 1 is a partial sectional view in perspective representation of an exemplary embodiment of the present invention, when viewed from the body shell of an object to be protected.

Fig. 2 is a partial sectional view in lateral perspective of the device in accordance with the invention.

Fig. 3 is a perspective view of a launcher housing for use with the device in accordance with the invention, and

Fig 4 is a perspective view from the inside of the body shell of the object to be protected, with launcher housings mounted on the body shell.

Fig. 1: What is shown is part of an embodiment of the present invention. The body shell 1 of a mobile object contains two recesses 2, behind each one of which 4 launcher tubes 3 are arranged so as to terminate flush with the inner wall of the body shell 1. Moreover the upper recess 2 is in the exemplary case covered by a radar-reflecting hatch 4 which opens when ammunition is deployed, to afterwards close aagin.

Fig. 2: What is shown is part of an embodiment of the present invention. The object shown in Fig. 1 is here represented after a rotation through approx. 30°. In addition, the upper recess is provided with a splash-proof protective cover 5.

Fig. 3: What is shown is part of an embodiment of the present invention. The launcher housing 6 contains a closable hatch 8 provided with a squeeze lock 7, through which loading of the launcher tubes takes place. Moreover the launcher housing 6 is provided with an outlet valve 9, a blow-off valve 10, and a connection facility for control with the aid of ignition means 12, secured by grounding means 11.

Fig. 4: What is shown is part of an embodiment of the present invention. Four launcher housings 6 are mounted on the body shell 1 of a mobile object in vertical arrangement. All launcher housings 6 are mounted on the body shell with the aid of adapters 13 so as to be able to operate at different angle of deployments. The launcher housings 6 are moreover equipped with a connection facility for controlling ignition means 12.

Example 1

All the features of the present invention presently described may be combined among each other so that any combinations fall within the scope of disclosure of the present invention.

One embodiment of the invention relates to a device for discharging any kind of mortar- and/or rocket-type ammunition and of signal devices, the device preferably being a launcher, as an integrated component in the outer shell of a mobile object, in the exemplary case a ship, wherein a recess 2 in the body shell 1 of the ship provided for passage of the deployed bodies is covered by cover means 4, whereby a heightening of the radar signature caused by this recess 2 and having a negative effect is diminished.

In another embodiment of the invention, one discharge tube 3 or several combined launcher tubes 3 for deploying the ammunition are integrated into the ship's hull so that the opening(s) of this launcher tube/of these launcher tubes terminate/s flush with the body shell of the ship (cf. Fig. 1). The launcher tubes 3 preferably have a laterally adjacent arrangement in at least one row, but may also be arranged obliquely above each other or circularly in at least one row, or in any other desired manner.

Moreover the opening in the body shell 1 thereby created is covered by radar-reflecting cover means 4 which only open upon deployment/discharge, whereby the smooth planar structure of the body shell 1 is largely preserved, and the reflection characteristics remain unchanged by 95-100%, preferably by 98-100%.

The cover means 4 are at least one camouflage hatch provided, in an exemplary case, with a hinge and a spring. A single camouflage hatch may be mounted both laterally of, above, or below the recess 2.

Where the cover means 4 consists of a plurality of camouflage hatches, these may be provided in the form of wing hatches or of annular or polygonal hatch segments.

The cover means 4 is opened only for an extremely short time by a passing body, to immediately close again following deployment of the ammunition.

Preferably the cover means 4 contains at least one material having elastic properties, preferably at least one rubber-type material with a radar-scattering coating,

preferably a radar-scattering metal coating or metal foil.

In another embodiment of the invention the launcher is located at a distance of 0-20 cm, preferably 0.5-15 cm, more preferably 1-5 cm from the body shell of the object.

In order to prevent water or contamining substances from penetrating during stand-by/peace-time operation, the cover means is in another embodiment additionally provided with a splash-proof protective cover 5 which is removed by the first shot. The protective cover is radar-scattering and terminates flush with the structure of the body shell 1. This is made possible by a corresponding shape of the protective cover 5.

In another embodiment, the additional protective cover may moreover be retained by a suitable mount (cf. Fig. 2). Particularly preferred is a simple snap-in means, but any other mounts known in the prior art are also applicable and encompassed by the present invention.

The discharge tube 3, or the set of launcher tubes 3 are, e.g., mounted on the inside of the body shell 1 of the ship such that loading the launcher tubes 3 from the inside of the ship's hull 1 is also possible.

To this end, the launcher tubes 3 in the example are arranged in a launcher housing 6 (cf. Fig. 3) which preferably is fixedly connected with the inside of the body shell 1 and open towards the side of the deployment opening. The launcher housing 6 moreover has at least one closable loading hatch 8 in the interior of the ship's hull 1, having the form of a squeeze lock 7 through which loading of the launcher tubes 3 takes place.

In another exemplary embodiment, the fastening of the launcher housing 6 on the inside of the body shell 1 and the loading hatch is executed with a gas-tight seal so as to prevent the penetration of contaminated substances into the interior of the ship during operation or upon re-loading through the launcher tubes 3.

Contaminating substances having penetrated into the interior of the launcher housing 6 as well as ammunition residues may in another embodiment be removed, e.g. prior to re-loading. This is carried out with the aid of a pressure pulse which may be exerted by using pressurized air. To this end, the launcher housing 6 is provided with a blow-off valve 10 which allows connection of a supply line through which the pressure-transmitting substance is introduced into the launcher housing 6. The pressurized air used in the exemplary case removes the contaminating substances or ammunition residues from the launcher housing 6 in a direction towards the opening of the launcher tubes 3.

The launcher housing 6 ist equipped with an outlet valve functioning as a outlet means, so that any penetrated liquids, in particular water, may be removed from the launcher tubes 3.

In another embodiment the launcher housing 6 includes a connection facility 12 for controlling the ignition means of the spurious target ammunition.

In the exemplary case, the launcher 6 includes electrical ignition means.

In another embodiment, a plurality of launcher housings 6 are preferably arranged side by side or in a

vertical arrangement (Fig. 4). Any other manner of arrangement is equally conceivable, however, and therefore encompassed by the scope of the present invention. The angle of deployment of the launcher tubes 3 is individually adjusted in lateral pointing and elevation by using adapters 13 in case the angle of the body shell 1 does not correspond to the intended angle of deployment. Hereby it is ensured that the launcher housings 6 of any ship thereby protected are identical, may be exchanged, and may be manufactured in cost-effective series production.

In the exemplary case, the angles of deployment relative to the normal of the ship's surface are 105°, 120°, 135° and 150°.